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AGRICULTURE

(FOUO 9/81)

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REGIONAL DEVELOPMENT

ADVICE FOR ABUNDANT WINTER CROP FROM NONCHERNOZEM ZONE

Moscow AGROTEKHNICHESKIYE SOVETY in Russian No 17, Sep 81

/Article: "Nonchernozem Zone: For a High Harvest of Winter Crops"/

/Text/ The decisions of the 26th CPSU Congress point to the need for an increase in the fertility of soil and in the yield of agricultural crops and for the further growth of the production of grain, fodder and other plant products.

Farms in the nonchernozem zone of the Russian Federation must make a significant contribution to the fulfillment of these decisions. Its soil and meteorological conditions make it possible to obtain high harvests of winter rye and wheat. Usually, in fall the rainfall there is sufficient for a good development of plants before wintering. By spring the moisture reserves in the root layer reach the field water capacity indicators and in combination with the precipitation of spring and the first half of summer (150 to 200 mm) guarantee no less than 40 to 60 quintals of grain per hectare.

Thus, the yield of winter crops is formed from the moisture reserves created during the fall-winter and early spring period. Furthermore, they ripen earlier than spring crops and farms can utilize harvesting machinery and drying equipment more productively.

The biological characteristics of winter crops make it possible to grow them in many regions of the nonchernozem zone. For example, winter wheat grows well on fertile soddy-podzolic soil. When promptly sown in fall, it develops the root system intensively and clusters well. It is sufficiently frost-resistant and winterhardy. It withstands a prolonged drought in summer.

Winter rye is less demanding of growth conditions. It tolerates an increased acidity (pH 5 to 5.3), is frost-resistant and winterhardy, develops a strong root system, tolerates a summer drought well and assimilates not easily accessible nutrients. The rapid growth and development during the fall and spring period enable rye, when the plant density is normal, to suppress weeds.

Agrotechnology

Placement. Wheat is more productive on subacid cultivated loamy soil well dressed with organic fertilizers. It grows poorly on drained peat bogs and on sandy and poorly cultivated sandy loam soil.

Winter rye is cultivated on soil differing in its mechanical composition, including sandy and sandy loam soil.

After the performance of drainage and amelioration operations winter crops can occupy the leading place on reclaimed land.

The selection of a predecessor in crop rotation is one of the main conditions for a high yield. Clean fallow is considered the best. Legume-grass mixtures, clover of the first year of use, early potatoes, perennial grass after one cutting, early silage crops and peas for grain are also good. On light soil rye is also cultivated after green-manured fallow.

When grain crops are harvested at an early date, it is possible to permit the sowing of wheat and rye after winter crops on well-cultivated and fertilized soil. In northern and eastern oblasts winter crops can be placed after barley of the early ripening Sever 1 variety.

Soil cultivation. Two types of clean fallow--black and early--are used in the nonchernozem zone. Black fallow is cultivated according to the type of fall plowing. In early spring for moisture retention soil is harrowed and in summer, in order to destroy weeds, it is cultivated in layers three or four times. Organic fertilizers are applied and turned under 1 to 1½ months before sowing.

The cultivation of early fallow is begun in spring. Organic fertilizers (30 to 40 tons per hectare) are applied and it is plowed, harrowed and cultivated in layers. The last presowing cultivation is at the depth of 5 to 6 cm.

For the cultivation of fallow occupied by vetch- and pea-oats mixtures, as well as pulse crops (if there are no perennial weeds), disk or share scuffling at the depth of 10 to 12 cm with a simultaneous packing with ring-grouser rolls is used. After preliminary scuffling plowing at the depth of 20 to 22 cm is carried out on plots infested with rootstock and suckering weeds. Basic soil cultivation is completed 2 or 3 weeks before sowing.

After the harvesting of perennial grass and other predecessors heavy disk harrows are immediately put into operation. They are followed by combined plowing units consisting of a plow, leveler and section of the ZKK-6A roll.

Units of the RVK-3 type are used for presowing soil cultivation. The uniformity and compaction of the surface soil layer are especially important during the cultivation of winter wheat, because in microdepressions it thins out severely or dies. Presowing soil cultivation is carried out simultaneously with sowing or 1 day before it.

Fertilization. The application of fertilizers according to a certain system enables winter crops to develop well beginning in fall. They winter better, grow well in spring, form stems and ears and produce a high harvest.

In order to determine the necessary amount of fertilizers for the planned yield, the data on the removal of nutrients with the grain and straw harvest and the coefficients of their utilization from soil and the applied fertilizers are used.

The greatest removal of nutrients with the harvest per 10 quintals of grain with due regard for straw is as follows: nitrogen--25 to 35 kg; phosphorus--12 to 15 kg; potassium--26 to 30 kg.

Organic fertilizers, a full dose of phosphorus and potassium fertilizers, are applied to basic soil cultivation. Part of the phosphorus fertilizers (15 to 20 kg of granulated superphosphate or nitroammophoska per hectare) are applied to rows during sowing. Nitrogen fertilizers are applied in two stages: 30 to 45 kg of active substance per hectare, to presowing cultivation and the remaining part, in the form of spring and summer topdressing. Ammonia water is applied during plowing or cultivation at the depth of 10 to 12 cm.

On acid soil lime is applied to the previous crop or immediately after its harvesting (before basic soil cultivation). Dosage is established depending on the mechanical composition and thickness of the arable layer and soil acidity.

Preparation of seeds for sowing. The wintering and yield of winter crops depend on the quality of seeds. Seeds should meet the requirements of the state sowing standard. Their germination rate should be no less than 90 percent and purity, not below 97 percent and they should contain up to 200 seeds of other plants, including no more than 50 weeds, per kg.

Seeds of regionalized varieties of the first and second category--better from the carryover stock--are used, because they ensure an increase of 2.5 to 5 quintals in the harvest. If they are not available, freshly harvested seeds are first subjected to air and thermal heating for 4 or 5 days, or are dried in floor dryers with active ventilation at the temperature of 45 to 50 degrees, while moisture is lowered to 14 or 15 percent.

In the control of covered and loose smut, fusarial wilt and helminthosporiosis seeds are treated with the following toxic chemicals (kg of preparation per ton): granosan with a dye, 1 to 2; TMTD, 1.5 to 2; pentathiuram, 1.5 to 2. The treatment is carried out in the special machines PZ-10, PS-10 and Mobitoks with a suspension of the preparation or through moistening, using 10 liters of the liquid per ton of seeds. Against pests seeds are treated with 12-percent hexachlorane-cyclohexane dust in terms of 15 to 20 kg of the preparation per ton of seeds.

Time of sowing. It is determined depending on the region's temperature conditions, length of the fall vegetation period, soil moisture and other natural factors. Deviation from the optimum time can lead to a significant decrease in the yield.

Winter crops winter best at the tillering phase, when three or four shoots are formed in rye and two or three, in wheat. Plants attain such a stage in development when the total average daily air temperature from the day of sowing until the temperature passes +5 is 480+60 degrees.

On the basis of scientific research the following approximate time of sowing winter rye (winter wheat is sown 3 to 5 days earlier) was established for various regions of the RSFSR nonchernozem zone:

northern region: the Komi ASSR, the Karel'skaya ASSR, Arkhangel'skaya Oblast and the north of Permskaya, Kirovskaya and Vologodskaya Oblasts--from 20-31 July to 10-15 August;

northeastern region: Permskaya and Kirovskaya Oblasts, the Udmurtskaya ASSR and the Mariyskaya ASSR--from 5 to 25 August;

northwestern region: Leningrad, Pskovskaya, Novgorodskaya and Vologodskaya Oblasts--from 5 to 25 August;

western region: Kaliningradskaya Oblast--from 20-25 August to 5-10 September;

central and southern regions: Moscow, Smolenskaya, Tul'skaya, Kaluzhskaya, Ryazanskaya and Vladimirskaya Oblasts, the south-west of Kalininskaya Oblast and the south of Gor'kovskaya Oblast--from 15-25 August to 5 September; Ivanovskaya, Kostromskaya and Yaroslavskaya Oblasts, the left bank of Gor'kovskaya Oblast and the north-east of Kalininskaya Oblast--from 10-15 to 20-25 August; the Mordovskaya ASSR--from 10 August to 1 September; the Tatar ASSR and the Chuvashskaya ASSR--from 5-10 to 20-25 August.

Seeding rates. They depend on climatic and soil conditions, the degree of soil moisture and temperature in fall and early spring, soil fertility and cultivation and the bushiness of plants (table).

Approximate Seeding Rates

Million of Germinated Seeds Per Hectare

Regions	Rye	Wheat
Northern	6.0-6.5	--
Eastern	5.5-6.0	6.0-7.0
Western	5.0-5.5	5.5-6.5
Central	4.0-5.0	5.5-6.0
Southern	--	5.0-5.5

When the sowing time is optimal and the entire agrotechnological complex is fulfilled, the recommended rates can be 10 to 15 percent lower and under dry weather conditions, especially when rye is placed on sandy and sandy loam soil, as well as during a late sowing period, 8 to 10 percent higher.

Sowing methods. In all the oblasts and republics of the RSFSR nonchernozem zone crossed and narrow-row methods ensure the highest yield of winter crops. Seeds are uniformly distributed over the entire area, plants utilize nutrients and moisture more efficiently and suppress the development of weeds more intensively. The farms that promptly prepare soil and sow at the optimum time use these sowing methods successfully.

Depth of seed placement. An insufficient depth leads to a decrease in field germination and sometimes the tillering node becomes exposed. When the depth is excessive, shoots appear much later and are weakened and thinned out.

On heavy soil the depth of rye seed placement should be 2 to 3 cm and on sandy and sandy loam soil, 4 to 5 cm.

The depth of winter wheat seed placement should not exceed 5 to 6 cm.

Care of crops. During the fall period the main task is to obtain good sprouts and to avoid their damage by pests. If seeds are placed excessively deeply and soil is too loose, it must be packed immediately.

Before the appearance of sprouts of winter crops weeds must be mowed on adjoining plots, because pests and diseases develop on them. They can damage sprouts. In the control of scentless mayweed, cornflower and loose silky bent treatment with simazine in the dose of 250 grams of active substance per hectare gives good results. The herbicide is applied immediately after the sowing of winter crops and before the beginning of plant tillering, for which the boom sprayers POU, ON-400, ON-400-1 and others are used.

In case of average and severe weediness of crops in spring treatment with herbicides is carried out at the phase of tillering of winter crops. The following are used on plots where spring weeds appear (kg of the preparation per hectare): 1.5 to 2.5--2,4-D amine salt preparation; 0.7 to 1.2--2,4-D butyl ether (butapon); 1.3 to 2 2M-4Kh, 80-percent soluble powder. In order to destroy weeds resistant to these herbicides (scentless mayweed, knotweed and hemp nettle), they are sprayed with dialen (1.9 to 3 kg of the preparation per hectare) and diamet-D (2.5 to 3.9) or are treated with granulated 10-percent butyl ether 2,4-D (10 to 12 kg) in a mixture with granulated ammonium nitrate during early spring topdressing. When the Swedish or Hessian fly appears, crops are dusted with 12-percent hexachloranecyclohexane in terms of 15 to 20 kg of the preparation per hectare.

In addition to chemical crop protection agents, spring care includes early topdressing of plants with nitrogen fertilizers and harrowing. All crops, including weakly developed and weakened, as well as those where viable sprouts have a normal plant stand, are topdressed. Topdressing is applied at the earliest time, using 30 to 45 kg of active substance of nitrogen fertilizers per hectare. In addition to this, root dressing with a complete mineral fertilizer by means of grain manure seeders is used. Nitrogen fertilizers are poured into a grain box and phosphorus fertilizers, into a fertilizer box. Fertilizers are placed at the depth of 4 to 6 cm.

The increase in the harvest from the root method of application is 2 to 3 quintals higher as compared with the broadcast method. The efficiency of this method increases in the zone's southern and southeastern regions, where the upper soil layer dries up rapidly, as well as on farms using intensive-type varieties.

The harrowing of winter crops in early spring is an important means of saving moisture. Along with this it contributes to the penetration of air to the roots of winter crops and to the destruction of snow mold and sclerotinia and improves microbiological activity. During harrowing poorly developed weeds are also destroyed and fertilizers applied in spring for topdressing are utilized better.

The lodging of crops does considerable damage to the winter field. Losses from it can reach 20 to 50 percent. At the same time, the quality of grain deteriorates considerably, labor productivity decreases and the expenditures on harvesting increase. The resistance of crops to lodging increases if the chlorocholine chloride preparation is applied to wheat and campozan, to winter rye. The average increase in grain from their application is 5 to 6 quintals per hectare. Chlorocholine chloride is sprayed at the end of tillering and at the beginning of shooting (2 to 4 kg of active substance per hectare) and campozan, in the middle of the shooting of plants (4 liters). The application of campozan should not be combined with herbicides.

Varieties. The following regionalized intensive-type varieties of winter wheat are recommended for the nonchernozem zone: Al'bidum 114, Zarya, Il'ichevka, Mironovskaya 808, Mironovskaya Yubileynaya, Ul'yanovka and Universal.

Of winter rye: Belta, Bambo, Voskhod 1, Vyatka 2, Gibrid 173, Kombayninyay, Krupnozernaya, Leningradskaya Tetra, Orlovskiy Gibrid, Saratovskaya 4, Ural'skaya, Khar'kovskaya 60, Chulpan and others. The majority of these varieties are resistant to lodging.

When new varieties are selected, their ripening periods are taken into consideration. For the convenience of harvesting it is desirable to have two or three varieties with various periods on a farm.

Harvesting. The selection of the harvesting method depends on the condition of crops and on weather conditions. Nonlodged short-stem overripe and thinned out crops are harvested by direct combining when the grain moisture is no more than 20 to 22 percent. Heavily weeded, lodged, high-stem crops, which do not ripen uniformly or with an additional plant stand, are swathed during the waxy ripeness of grain of a moisture of 30 to 35 percent. Swaths are picked and thrashed when full ripeness is reached. On lodged crops harvesting units are put into operation in a lateral direction. A correct combination of direct combining and swath harvesting makes it possible to harvest in a more organized way, without losses and in any weather.

The experience of advanced farms in the zone, as well as of farmers in Ipatovskiy Rayon in Stavropol'skiy Kray, shows that the efficiency of utilization of equipment in the harvesting of grain crops greatly increases with its quality preparation, use of advanced flow technology, large-group operation of combines, prompt technical servicing and effective socialist competition.

Workers of the nonchernozem zone! To obtain high and stable winter grain harvests make use of the achievements of science and of the experience of advanced farms. This will make it possible to greatly increase the gross output of grain from the winter field.

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AGRO-ECONOMICS AND ORGANIZATION

PERSONNEL REQUIREMENTS FOR INTER-ENTERPRISE ANIMAL HUSBANDRY COMPLEXES

Moscow MEZHKHOZYAYSTVENNO-ZHIVOTNOVODCHESKIYE OB"YEDINENIYA in Russian 1979 pp 246-262

[Article by V. A. Kovalev, deputy chief of the Main Administration for Personnel of the RSFSR Ministry of Agriculture: "Personnel Under Inter-Enterprise Cooperation" and table of contents from the book "Inter-Enterprise Animal Husbandry Associations"]

[Text] Coincidental with strengthening the logistical base of agriculture, accelerating technical re-equipping and converting production over to an industrial basis, the multi-branch character of many kolkhozes and sovkhozes has begun to restrain the process of scientific-technical re-equipping and to slow down the intensification of agriculture.

Further development of the productive forces requires a basically new approach for organizing agricultural production, more flexible agricultural specialization and the combining of farm efforts for the purpose of making more extensive use of the achievements of scientific-technical progress.

Numerous examples could be cited showing how production specialization and concentration have exerted a positive effect on the work of large-scale mechanized farms, complexes and other specialized enterprises and on their economic indicators. Labor expenditures for the production of a unit of output at such facilities are lower by a factor of 2.5-3 and production costs by a factor of 1.5-2 than the figures for non-specialized farms.

Specialization and concentration of agricultural production based upon inter-enterprise cooperation and agroindustrial integration have recently been developed extensively. The creation of inter-enterprise and production associations is making it possible to solve an important administrative problem -- the establishment of cost accounting relationships for all administrative levels: brigade - department (branch) - farm - association. This ensures flexibility for the organs of administration and raises their responsibility.

The lowest administrative level in an inter-enterprise organization or association is a production brigade and the highest -- the administrative organization of the enterprise or association, headed by a council. The activities of the principal subunits (services) and officials are regulated by statutes dealing with the structural subunits and by official instructions for workers attached to the administrative organization.

The administration of an inter-enterprise organization is carried out by a meeting of authorized representatives of participating farms and a council elected by them for the inter-enterprise organization and daily management -- by the director (chairman) of the inter-enterprise organization, who simultaneously serves as the chairman of the council of this association. This applies to an equal degree to both kolkhozes and sovkhozes performing the functions of an inter-enterprise organization. There is one difference however. At kolkhozes and sovkhozes which perform these functions, the meeting of representatives and the council provide direction only for that portion of production that is inter-enterprise in nature (complex for the maturing of young stock, complex for the fattening of livestock and so forth).

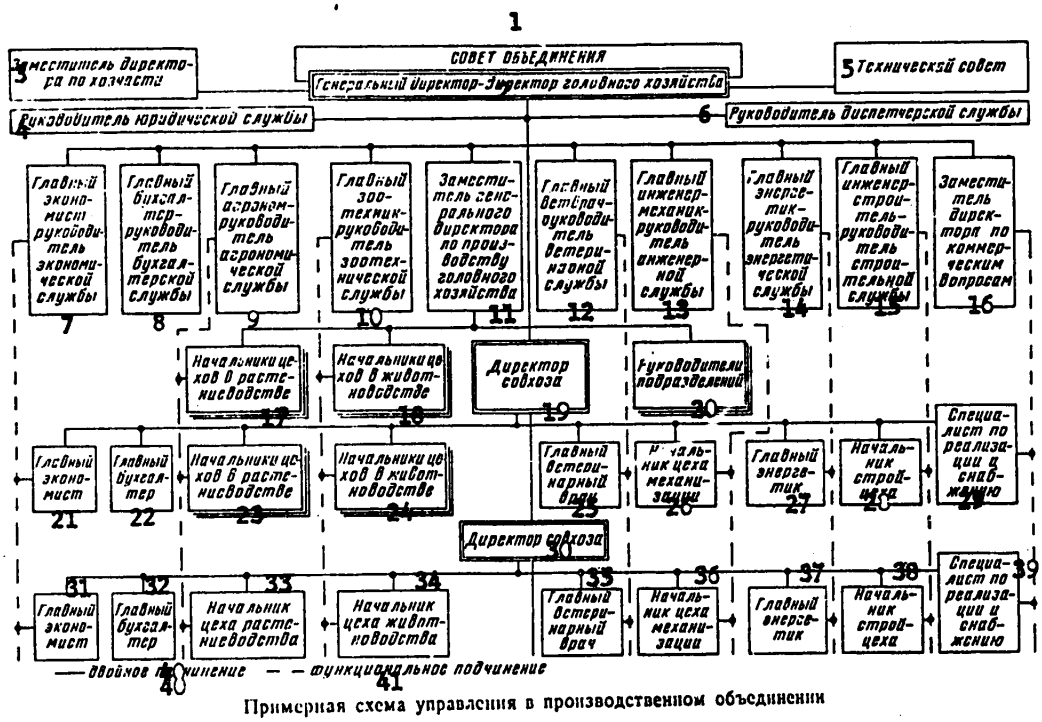
The highly specialized nature of production is making it possible to carry out intense specialization and concentration of agricultural production and it is resulting in use of the branch principle of administration. Under a departmental structure, the role played by specialists is raised. In addition to technological functions, they must also perform the functions of production organizers. Planning, accounting, supply, marketing and municipal and everyday services are all centralized to the maximum possible degree at such enterprises and subunits which perform these functions become large elements of the highest level of administration.

One feature of an inter-enterprise organization is that it is organized at a base and using the resources of farms -- participants in cooperation. Thus, in the administrative structure of an inter-enterprise organization and in addition to the workers assigned to the organs of administrative control, collective organs are created: a meeting of authorized representatives, a council of the inter-enterprise organization and an auditing committee.

From each participating farm, regardless of its size or degree of participation, an equal number of representatives are elected or assigned, for a period of 3 years, to the highest administrative organ of an inter-enterprise organization -- the meeting of authorized representatives.

The meeting of authorized representatives convenes no less often than once annually. During this meeting the regulations for the inter-enterprise organization are approved and the members of the council and the auditing committee are elected for a period of 3 years. The council of the inter-enterprise organization approves its production structure and established the number of administrative staff personnel. The annual reports concerning production-financial activities and the draft economic plans for social development are examined. These reports and draft plans are submitted by the council for approval during the meeting of authorized representatives of the shareholder-farms. The council exercises operational control over the production-economic activities of the association.

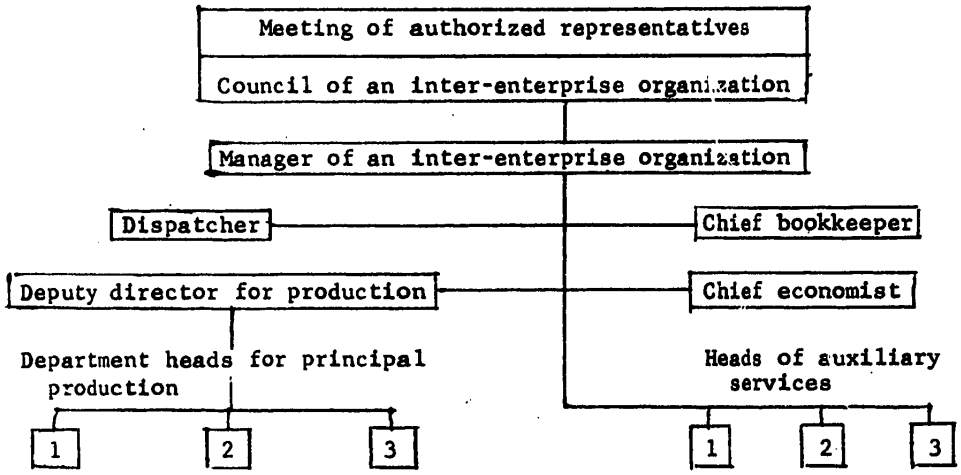
Within the production association, a leading role is played by a collective organ -- the council of the association. The structure of the council includes a chairman (general director) of the association and his deputies -- kolkhoz chairmen, sovkhoz directors and the leaders of other state and cooperative enterprises and associations belonging to the association. Specialists from the association's administrative organization and enterprises included in its structure, leading production figures and the representatives of public organizations all participate in the work of the council.



Примерная схема управления в производственном объединении

Diagram of a production association administration

1. Association council
2. General director; director of the leading farms
3. Deputy farm director
4. Director of legal services
5. Technical council
6. Director of dispatcher services
7. Chief economist/head of economic services
8. Chief accountant/head of accounting services
9. Chief agronomist/head of agronomy services
10. Chief animal specialist/head of animal services
11. Deputy general director of the leading production farm
12. Chief veterinarian/director of veterinary services.
13. Chief engineer/director of engineering services
14. Chief power engineer/director of power services.
15. Chief construction engineer/director of construction
16. Deputy director of commercial services
17. Chiefs of vegetable farming sections
18. Chiefs of animal husbandry sections
19. Sovkhoz director
20. Chiefs of subunits
21. Chief economist
22. Chief accountant
23. Chiefs of vegetable farming sections
24. Chiefs of animal husbandry sections
25. Head veterinarian
26. Head of mechanization section
27. Chief power engineer
28. Head of construction section
29. Procurement specialist
30. Sovkhoz director
31. Chief economist
32. Chief accountant
33. Chief of vegetable farming section
34. Chief of animal husbandry section
35. Chief veterinarian
36. Chief of the mechanization section
37. Chief power engineer
38. Head of the construction section
39. Procurement specialist
40. Dual subordination
41. Functional subordination



Model diagram for administration in an inter-enterprise organization of an association

The association's council directs the production-financial activities of all of the enterprises and organizations subordinate to it. The implementation of the decisions handed down by the council is carried out by the association's administrative organization headed by a general director, who bears personal responsibility for the status of affairs and the activities of the association.

The manager of the leading enterprise must be the chairman (general director) of the association. In associations having a detached administrative organization, the chairman of an association is elected by the council of the association.

The functions of the association's administrative organization at the leading enterprise include: planning, logistical support, centralized distribution of funds, reporting to the higher organs of administration and external communications. The administrative organization of the leading enterprise is also responsible for introducing the achievements of science and leading practice into operations at all of the farms of the association.

With the creation of the associations, a considerable increase has taken place in the volume of information available on the work of an association, its subordinate farms and their subunits. Thus the organization of dispatcher services is deemed advisable. They can ensure the collection of information on the status of production and on plans for impending work, the transmission of urgent orders and control over the fulfillment of plans, schedules, tasks and so forth.

Prior to the organization of the associations, each sovkhoz manager and specialist carried out all of the principal administrative functions, solved the long-range and operational problems associated with production, supply, marketing and construction and resolved problems concerned with municipal and everyday services and other matters. This lowered the effectiveness of administrative work, it resulted in unnecessary parallelism and duplication and it lowered operational responsibility.

TABLE 1

Number of Administrative and Production Personnel at a Milk Production Complex

	Complex for 2,000 head
Management	14
Production personnel	43
Service personnel	31
Including:	
Department for technical services and repair	11
Sanitary lines	10
Pumping station	3
Creamery	5
Dining hall	2
Total for the complex	88

The centralization of administrative work and the carrying out of this work by specialized services made it possible to regulate the labor of workers and to provide them with more free time for solving long-range problems and for performing economic analysis. Prior to centralization of the commercial service, the chief specialists at sovkhozes spent 8-10 percent of their time carrying out supply-marketing operations and during certain tense periods -- up to 18-20 percent. Under centralized management, the chief specialists almost never concern themselves with supply or marketing.

Tables 1, 2 and 3 furnish figures on the number of administrative and production personnel at complexes for milk production, for the raising and fattening of young large-horned cattle stock and for swine raising complexes. In the tables cited, it is noted that the engineering-technical workers and other workers carry out an entire volume of work and have responsibilities, including observance of the norms of effective legislation and the established duration of the working day.

At the present time, with inter-enterprise cooperation being employed on a more extensive scale, great importance is being attached to the work of forming an administrative organization and to the training and retraining of skilled personnel for complexes engaged in the production of goods on an industrial basis and other agricultural enterprises of the new type. When solving the task concerned with supplying personnel for these enterprises, emphasis should be placed upon the fact that the problems concerned with the training and retraining of specialists and personnel in the mass professions should be solved taking into account the scales for the development of inter-enterprise cooperation and agroindustrial integration.

The inter-enterprise organizations and associations must be managed by highly skilled specialists who have mastered the latest methods for organizing and controlling production. At the same time, the personnel must understand the objective need for the measures carried out, they must knowledgeably and creatively solve their specific tasks and they must constantly master scientific-technical achievements and the modern administrative methods, in the interest of ensuring that organization and administration in the inter-enterprise organizations and associations are developed on a strictly scientific basis. Those managers and

TABLE 2

Number of Administrative and Production Personnel at a Complex for the Raising and Fattening of Young Large-Horned Cattle

	10,000 Head (raising and fattening)	Fattening Site		
		30,000 head	20,000 head	10,000 head
Management and specialists	16	10	8	6
Production personnel, directly engaged in servicing the animals	73	41	17	28
Service personnel	29	14	6	10
Including:				
Sanitary lines	11	-	-	-
Other personnel	18	-	-	-
Total for complex with replacements	118	65	31	44
Including workers	97	51	23	34
Of these workers, those directly engaged in servicing the animals	73	41	17	28

specialists who have not thoroughly mastered the theory and practice of inter-enterprise and agroindustrial cooperation will be unable to organize and direct the fulfillment of tasks associated with further specialization and concentration of agricultural production.

At the present time, there are almost 800,000 specialists with higher or secondary educations working in agriculture in Russia. Each year, more than 19,000 graduates of VUZ's and 55,000 graduates of technical schools are being assigend to work at kolkhozes and sovkhozes. Today there is an average of 19 specialists at a kolkhoz and 35 at a sovkhoz. The increase in the number of specialists has made it possible to strengthen the structure of managerial personnel at the kolkhozes and sovkhozes.

Jointly with the party and soviet organizations, the agricultural organs are giving special attention to the selection and placement of personnel at the associations and complexes. Highly skilled workers, individuals who have proven themselves to be good production organizers and who possess a great amount of work experience at kolkhozes and sovkhozes are being assigned to serve as managers and chief specialists.

The chief specialists of an association are mainly production organizers and technologists. They must possess a thorough knowledge of the progressive technology, the economics of production, the latest scientific achievements and leading practice and they must constantly improve their professional training.

The specialists of farms and administrative organs at inter-enterprise organizations and associations are able to devote a great amount of attention to the principal branches, to obtain a thorough understanding of the production specifics, to manage the branches in a more skilled manner and to improve the production technology.

TABLE 3

Number of Administrative and Production Personnel at Industrial Complexes for the Raising and Fattening of Swine

	Complex		
	108,000 Swine Annually	54,000 Swine Annually	12,000 Swine Annually
Management	6	5	1
Specialists of services	27	14	4
Production personnel directly engaged in the servicing of animals	160	80	28
Service personnel of a complex: department for processing of farmyard manure and purification of waste water	42	24	8
Water supply department	16	10	3
Group for the technical servicing and repair of equipment	68	30	4
Sanitary service and artificial insemination station	12	5	-
Slaughtering-sanitary station	4	4	1
Veterinary bacteriological laboratory	5	-	-
Boiler unit	35	35	16
Total for the complex, with replacements	374	207	65
Including workers	301	166	59
Of workers, those engaged directly in the servicing of animals	160	80	28

Early on in the organization of inter-enterprise organizations and association, difficulties arose in connection with the training of managers and specialists in the new administrative forms and the new production technology. No experience was available in this regard. Instruction was furnished in other branches of the national economy and foreign experience was employed. Little by little the inter-enterprise organizations and associations accumulated their own experience. Using existing associations such as Leto and Novyy Svet in Leningrad Oblast, enterprises and inter-enterprise associations in Moscow, Tul'skaya, Vladimirskaya, Penzenskaya and Voronezhskaya Oblasts and also complexes for the production of goods on an industrial basis, training was organized for the personnel of newly created inter-enterprise organizations and associations.

Prior to being assigned to work at a complex, the specialists had to undergo a probationary training period at existing complexes or retraining in VUZ departments or in schools for improving the skills of workers. Such retraining was carried out taking into account the particular specialization at the inter-enterprise organization or association.

During the course of retraining, considerable attention was given to studying scientific labor organization, the problems concerned with planning and analyzing agricultural production, the latest technologies and also scientific achievements and leading practice. In the conduct of the exercises, extensive use was made of scientists, managers and specialists from the inter-enterprise organizations and associations.

During the past few years, basic training was begun for specialists assigned to inter-enterprise organizations and associations, directly at higher and secondary specialized educational institutes. There are presently 55 higher educational institutes and four of their branches engaged in training highly skilled specialists for Russian agriculture. They are furnishing training in 34 professions and 42 specializations. Since 1973, the zootechnical departments have been converted into zooengineering departments, with the zooengineers presently being trained in 14 specializations -- milk production on an industrial basis, meat production on an industrial basis and so forth. In addition to biological knowledge, a zooengineer is provided with the required technical training and organizational skills.

In the training programs for a majority of the technological and economic disciplines at higher and secondary educational institutes, sections have been introduced for the production of agricultural products on an industrial basis and under conditions involving production specialization and concentration and the organizational-economic and engineering training of future specialists has been strengthened. For a number of years now the agronomic faculties and departments have been training agronomists for feed production for animal husbandry complexes, scientific-technical training for all of the agronomic specialties has been strengthened and a new course has been introduced for the operation of a machine-tractor pool under conditions involving production specialization and concentration. The training of specialists in the automation of agricultural production has commenced.

Norms for the Servicing of Livestock at Milk Production Complexes for 800 and 2,000 Head

	Number of Head Per Operator	
Milking of cows	135*	47**
Tending of cows	270	
Artificial insemination	800	

* Yelochka milking unit
** ADM-8 milking unit

Norms for the Servicing of Livestock at Complexes for the Raising and Fattening of Young Large-Horned Cattle Stock

	Number of Head Per Operator
Raising of calves	180
Fattening of young stock	720

Strong changes have been introduced into the organization of practical work by students at higher educational institutes and technical schools. Towards this end, extensive use is being made of agroindustrial enterprises and associations and also complexes for the production of field crop husbandry and animal husbandry products on an industrial basis. Fine business-like relationships have been established at the Moscow Agricultural Academy imeni K.A. Timiryazev and at technical schools throughout the oblast with the Moskovskiy Sovkhoz-Combine, where vegetables are being grown under glass on an area of 56 hectares, with the Shchapovo Dairy

Complex which has more than 2,000 milking cows, with the imeni 50-Letiya SSSR Swine Raising Sovkhoz-Combine which fattens 100,000 swine annually, with the Voronovo Complex for the fattening of young large-horned cattle stock and also with large-scale inter-enterprise organizations.

Norms for the Servicing of Livestock at Animal Husbandry Complexes for the Production of Pork

	Number of Head Per Operator
Tending of boars	70
Artificial insemination	125
Tending of unmated and pregnant sows during the 1st period of pregnancy	280
Tending of sows during 2d period of pregnancy	800
Tending of young weaning pigs	3800-4200
Tending of animals during fattening	1800

During the creation of inter-enterprise organizations and associations and in the construction of complexes, a requirement arises for specialists in such professions as sanitary engineering, control-measurement instruments, automation, heat engineering, purification installations and so forth. Specialists in these and other professions who were not trained at agricultural educational institutes are assigned to work at associations and complexes from educational institutes of other branches of the national economy.

A most important condition for highly efficient work at inter-enterprise and agroindustrial organizations and associations is that of assigning specialists to the middle and lower echelons of production. An agronomist, zootechnician or other agricultural specialist is an organizer and technologist for his branch. The specialists are obligated to ensure constant scientific-technical progress and to raise the efficiency of the branch of agricultural production assigned to their care.

In raising the role played by specialists, great importance is attached to the efficient organization of their activities in conformity with their official duties and also to the carrying out of periodic certification. Certification, preparation for the certification committee, a personal report on their creative work and participation in the introduction of scientific labor organization and in social life -- these are all factors which stimulate the work of a specialist, promote improvements in the managerial style and methods employed for an assigned sector of work and raise the need for improving the necessary skills.

A most important sector of personnel work at inter-enterprise organizations and associations is that of assigning specialists to the managerial structure of departments (sectors) and sections, brigades and farms. For it is here that the bread, meat, milk, potatoes and vegetables are produced. This managerial echelon in agriculture must be staffed with competent specialists, individuals who are good organizers, possess administrative skills, can work with people and are capable of organizing agricultural production on a modern scientific level.

In October 1977, the CC CPSU and the USSR Council of Ministers adopted the decree entitled "Additional Measures for Stimulating the Conversion of Agricultural

Specialists Over To Work As Managers of Sections, Brigades, Farms and Other Subunits of the Middle Echelon of Production at Kolkhozes and Sovkhozes." This decree is eliminating an entire series of factors which in the past has delayed the conversion of specialists over to work as middle echelon managers. These positions are classified as being in the ITR [engineering and technical personnel] category. Individuals who convert over to work in the middle echelon retain their specialist wages and at the same time they become entitled to receive the bonuses established for workers for above-normal output. The publication of this decree was warmly received by the agricultural specialists, many of whom have expressed a desire to convert over to work in the middle echelon. Prior to being assigned to the position of manager of a brigade or farm, the specialists undergo training at schools for agricultural administration.

The creation of large scale socialist agricultural enterprises and the collectivization of labor during the course of inter-enterprise cooperation and agroindustrial integration have raised the need for rational specialization and division of labor. The profound changes that have taken place in the rural areas, associated with the industrialization of production, have brought about the appearance of many new professions in agriculture.

The basic training for highly skilled workers is carried out in agricultural professional-technical institutes. It is in these educational institutes that it is possible to provide a graduate with a volume of knowledge that will enable him to participate immediately in production, to master new equipment and technologies and to improve his professional expertise.

The conversion of animal husbandry over to an industrial basis and its specialization raised a requirement for training operators for the raising and fattening of large-horned cattle, swine and sheep at animal husbandry complexes; masters of machine milking; operators for the preparation and dosing of feed and so forth. The supplying of the farms with complicated and powerful equipment brought about specialization in technical servicing and repair operations. A requirement developed for training expert trouble-shooters for the technical maintenance of the vehicle and tractor pool, repair-mechanics and so forth. In connection with the development of agroindustrial and inter-enterprise associations, skilled workers were required for enterprises engaged in the processing and storage of agricultural products and for subsidiary trades.

The central figure in agricultural production continues to be a versatile machine operator, the training of which is carried out taking into account the development of specialized subunits and farms.

Whereas 10 years ago the institutes trained workers mainly for three professions, at the present time the SPTU [agricultural professional-technical institute] is annually training workers in ten professions. In addition to the training of workers within the system of agricultural professional technical institutes, they are also undergoing training directly in the inter-enterprise organizations and associations. Here special importance is attached to probationary training periods conducted directly at the working positions.

The great and profound changes that have taken place in agriculture have raised a need for augmenting the ranks of workers in the mass professions. With each passing

year, more and more young men and women are commencing work in agriculture -- on farms, in brigades and at animal husbandry complexes.

The professional orientation of youth commences in the junior grades, it is continued in student production brigades and labor and recreation camps and it is carried out with maximum consideration being given to the personnel requirements of the sovkhozes and kolkhozes.

The initiative displayed by graduates of schools in Kostromskaya Oblast, who expressed a desire to work in the rural areas met with a warm response. Thus, in 1978, more than one half of the students in Serebryano-Prudskiy Rayon in Moscow Oblast remained to work on farms in the rayon.

In recent years the personnel staff at the Serebryanyye Prudy Sovkhoz has been supplemented to a considerable degree by graduates from a local school. A great amount of work is being carried out at the sovkhoz in this regard. At joint meetings of the sovkhoz and school party organizations, discussions are held on problems concerned with improving education. The leaders, specialists and leading production workers are constant participants in school gatherings and evening meetings. They inform the students regarding the farm and the prospects for its development. The sovkhoz is doing everything possible to ensure that the students, while still attending school, participate in the work of the sovkhoz. In this manner they will be able to test themselves in the carrying out of genuine labor and experience joy in having done so. For example, 20 senior class students worked here on combines during the summer of 1978. At the sovkhoz there is a labor and recreation camp for the students where, in addition to relaxing, they are also able to accustom themselves to useful labor -- by performing work at animal husbandry farms or out on the fields. Each year one half of the graduates remains on the farm, becomes qualified and improves their expertise.

Experience has shown that it is not enough to merely appeal to the youth. Paternal concern for them is also required. And in those areas where this fact is recognized, success usually follows.

At the Mir Sovkhoz in Moscow Oblast, the farm managers issue all kinds of incentives to the youth -- new equipment is made available, concern is shown for raising their knowledge and they are provided with comfortable apartments. Twenty four individuals are presently undergoing training at the expense of the sovkhoz, while 12 other workers are working on correspondence courses from educational institutes. There are 232 young workers working at the sovkhoz at the present time, or 30 percent of the overall number of sovkhoz workers.

A patriotic movement has been launched at a secondary school in Ruzskiy Rayon -- after receiving one's certificate attesting to secondary education, to proceed to work on a project in the nonchernozem zone. At the present time, youth brigades and teams consisting of graduates of schools have been created at kolkhozes and sovkhozes. Approximately 3,500 graduates of rural schools in Moscow Oblast have vowed to devote their lives to agriculture.

In 1977, there were 203 student production brigades in Moscow Oblast with 27,400 students working in them, in Kalininskaya Oblast the figures were 185 and 11,000

respectively, in Ryazanskaya Oblast -- 248 and 22,300 and in Smolenskaya Oblast -- 114 brigades and 9,900 students. According to the results of an all-russian socialist competition, during 1977 Kalininskaya Oblast occupied third place for the best work by student production brigades. The students of rural schools in Lukhovitskiy Rayon in Moscow Oblast earned the challenge red banner of the RSFSR Council of Ministers and the AUCCTU.

During an all-union competition for masters of machine milking, held in July 1978 in the city of Kostroma, Natasha Pavlenko, a student at the Serkovskaya Secondary School in Shchelkovskiy Rayon in Moscow Oblast won first place among students in the central region. Olya Petrenko, of the Guzyatinskaya Secondary School in Bologovskiy Rayon in Kalininskaya Oblast, distinguished herself during a competition for young horticulturists -- she won third place for the RSFSR.

The principal form of training for personnel assigned to inter-enterprise organizations, associations, kolkhozes and sovkhozes is that of agricultural professional technical institutes.

Each year, approximately 4,000 young men and women are accepted at agricultural professional technical institutes in Moscow Oblast, in Ryazanskaya Oblast -- 5,200, Smolenskaya Oblast -- 3,400 and in Kalininskaya Oblast -- 4,300. However, at the present time the agricultural professional technical institutes are unable to satisfy fully the requirements of agricultural production for skilled personnel. Thus a large number of personnel are undergoing training within the system of course training conducted directly on the farms. In 1977, more than 100,000 workers were trained in this manner for kolkhozes and sovkhozes in the nonchernozem zone, including approximately 60,000 machine operators.

In addition to training new personnel, improvements are also being carried out annually in the qualifications and classifications of machine operators, animal husbandrymen and field crop husbandry workers. As a result, the number of 1st and 2d class tractor operators in Moscow Oblast as a whole amounted to 58 percent. Forty five percent of the machine milking operators bear the title of master of animal husbandry 1st or 2d class.

The holding of competitions by professions is promoting improvements in professional expertise and the retention of youth in the rural areas. It is during a competition that the best experts come to light, individuals who truly love their work and are able to carry it out in the best possible manner.

Many celebrated masters of their professions are working at complexes, inter-enterprise organizations and associations. In addition to achieving high indicators for themselves, they are also furnishing assistance to younger workers in mastering their professions, acquiring expertise and achieving high results. These are tutors of youth -- patient and wise teachers.

"Tutors" stated Comrade L.I. Brezhnev during a speech delivered before the 17th Komsomol Congress, "these are personnel workers who possess a high level of expertise, who are rich with life's experiences and who, I might add, are talented teachers. By virtue of their own good will, they instill a love for work in youth, they aid them in developing expertise and they acquaint them with the heroic traditions of our glorious working class."

The list of fine tutors includes: Hero of Socialist Labor and brigade leader of an all-round brigade at the Kolkhoz imeni Uritskiy in Smolenskaya Oblast A.B. Sergeyeva, Hero of Socialist Labor and brigade leader of the Zaokskiy Sovkhoz in Moscow Oblast G.I. Rybakova, team leader at the Serebryanyye Prudy Sovkhoz I.S. Averin, a milk maid at the Bol'she-Alekseyevskoye State Breeding Plant A.G. Pastukh, chairman of the Rossiya Kolkhoz in Istrinskiy Rayon T.I. Baryshev and many others.

The inter-enterprise organizations, kolkhozes and sovkhozes are carrying out a great amount of work in connection with improving the working and living conditions of kolkhoz members and sovkhoze workers and transforming the villages and hamlets into well organized settlements. As a result, the standard of living of rural workers is improving at a rapid rate. A considerable expansion has taken place in the scale of housing and cultural-domestic construction. The level of civic improvements in dwellings and cultural-domestic installations has been raised. Improvements have been achieved in domestic services for the rural population. Combines have been created in all of the rayons and at a majority of the kolkhozes and sovkhozes -- domestic services buildings or all-round receiving points.

The experience and lessons learned during the staffing of inter-enterprise organizations and associations with personnel underscore the fact that the new forms for organizing production are imposing higher demands with regard to the selection, placement and improving the skills not only of managerial workers and specialists but also of personnel in the mass professions. A great amount of work lies ahead. The party, soviet and economic organs and all agricultural workers are striving to solve their tasks in an organized and creative manner, tasks which are called for in the overall program prepared by the party for the development of socialist agriculture. Under these conditions, maximum support should be given for the initiative being displayed by the inter-enterprise organizations and associations; using their own savings and in addition to expanding production operations, they are creating a training base for training and improving the skills of their personnel.

The conversion of agricultural production over to an industrial basis is not just a technical matter; the force of traditions and usual personnel thinking must be overcome. In connection with the conversion over to new operational methods, a broad range of new problems will arise and in addition to organizational and technological problems there will also be those of a social and psychological nature.

All agricultural organs, kolkhozes and sovkhozes must concern themselves on a daily basis and in a purposeful manner with the practical implementation of the CC CPSU decree entitled "Further Development of Specialization and Concentration of Agricultural Production Based Upon Inter-enterprise Cooperation and Agroindustrial Integration." Under present conditions, this is one of the more important tasks. Specialization and concentration of agricultural production based upon inter-enterprise cooperation and agroindustrial integration are opening up broad opportunities for transforming this branch into a highly developed sector of the economy and for realizing high quality changes in social relationships in the rural areas. This corresponds to the basic interests of municipal and rural workers and to the tasks of communist construction.

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WATER RESOURCES

POTENTIAL FOR INCREASING EFFICIENCY OF USSR IRRIGATION

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[Article by Dmitriy Timofeyevich Zuzik, doctor of agricultural sciences, professor at the Moscow State Institute of Water Reclamation: "Reserves for Increasing Efficiency of Irrigation"]

[Text] Irrigation becomes more important each year. The proportion of products obtained from irrigated areas in the overall amount of farming products increased to 22-25 percent under the Tenth Five-Year Plan. During the period from 1965 through 1979 alone the irrigated areas increased from 9.9 to 17.0 million hectares (6 percent of all the planted area), and the overall amount of capital investments in irrigation exceeded 50 billion rubles during this time.

Irrigation has begun to be used not only in the desert and semi-desert regions of Central Asia, Southern Kazakhstan and the Caucasus, but also in the steppe, forest steppe and nonchernozem regions, the so-called new irrigation regions, where most of the agricultural products are produced on non-irrigated land. Non-irrigation farming will continue in the future to play the main role in this region, but the importance of irrigation as a means of increasing the productivity of farming will increase. During the first years of Soviet power less than 10 percent of the 4 million hectares of irrigated land was in new regions, under the Seventh Five-Year Plan (figures for 1965)--almost 30 percent, and by the end of the Tenth Five-Year Plan--more than 50 percent. The irrigated areas will continue to increase in the traditional regions of irrigation farming, but at less rapid rates.

The level achieved in the production of agricultural products on irrigated land in all regions of the country does not yet fully justify the expenditures that have been made. Large areas of irrigated land are not used at all in agricultural circulation (in 1979--0.6 million hectares), and many areas are not watered (in 1979--0.8 million hectares). The water that is at the disposal of the irrigation systems and agricultural enterprises and also the fixed capital for irrigation are not being adequately utilized. A number of decrees of the CPSU Central Committee and the USSR Council of Ministers point out the need to eliminate these shortcomings and increase the efficiency of irrigated land. The "Main Directions for the Economic and Social Development of the USSR During 1981-1985 and the Period up to 1990" set the task: "to achieve an all-around increase in the efficiency of the utilization of irrigated and drained land . . . to implement measures for the efficient expenditure of water for the needs of agriculture and improvement of the condition of irrigated and

drained land . . . to work more rapidly to reconstruct existing land reclamation systems and to improve their water supply . . ." The USSR water reclamation business has great reserves for efficiently carrying out these assignments in the next few years.

The incomplete return from irrigated land is related primarily to the unsatisfactory utilization of water resources that are at the disposal of irrigation systems and agricultural enterprises. Irrigation norms are not adequately substantiated and are not observed; a large quantity of water that comes into the irrigation systems is not used for flooding and is uselessly discharged from the systems and lost in filtration, augmenting the ground water supply and deteriorating the condition of irrigated land and non-irrigated land adjacent to it. Only about half of the water intended for irrigation is used to increase productivity, and even less of it is used in certain systems. The reason for this situation consists not only and not so much in the technical imperfection of the irrigation systems as in shortcomings in planning, designing, constructing and operating them.

In 1966 the system of the USSR Ministry of Land Reclamation and Water Management established a 95-percent supply for irrigation, according to which the irrigation systems should be planned for operation during the most arid years which occur no more than five times a century or once every 20 years. This means that during 95 out of 100 years all irrigated land should be provided with water according to the norms that are required only in the rare, most arid years, so the water assigned to the irrigation systems and farms will not be utilized efficiently during 95 of these years. This pertains mostly to the steppe, forest steppe and nonchernozem regions where the irrigation norms for the most arid years greatly exceeds the norms for the less arid ones.

As autonomously financed enterprises that are interested in efficient utilization of the water and land resources at their disposal, the kolkhozes and sovkhozes, violating the provision concerning the 95-percent supply, have begun, on their own initiative and at their own expense, to increase the irrigated areas (to adjacent non-irrigated land) and as a result have obtained a significant quantity of additional products. In the Ukraine the irrigated land that is not intended to be irrigated is called "accompanying hectares," in the Northern Caucasus, Buryatiya and other regions, they are called areas of "initiative" and "mobile" irrigation, and in the materials of the USSR Central Statistical Administration this land is given the name "irrigations on non-irrigated land." In 1979 the calculated area with irrigations on non-irrigated land reached 1.1 million hectares, about half of which is being irrigated with mobile equipment. This provides an important opportunity for agriculture to use irrigations on that land and those crops which during one year or another or for a period of more than a year require additional moisture and it makes it possible to obtain a greater effect.

The provision concerning the 95-percent calculated supply became invalid with the introduction in 1979 of the new Construction Norms and Rules of the USSR Gosstroy, according to which the calculated supply should be established for each irrigation object on the basis of technical and economic comparisons of the various variants of the calculated provision and the selection of the most economical of them. A correct ratio between irrigation water assigned to the systems and irrigated land determines the economic effectiveness of irrigation measures.

Table 1. Technical and Economic Indicators for Irrigation Object in Steppe Region With Various Levels of Calculated Water Supply for Irrigation

	Units of Measurement	Variants of calculated water supply for irrigation				
		95% for driest year	75% for medium dry year	50% for average year	25% for medium wet year	5% for wet year
Resources of irrigation water	millions of cubic meters	50	50	50	50	50
Annual utilization of irrigation water during many-year period	"	25.5	35.4	44.5	49.2	50.0
Average weighted irrigation norm	cubic meters per hectare	5000	3500	2500	1500	1000
Area with irrigation network	thousands of hectares	10.0	14.3	20.0	33.4	50.0
Actual irrigated area per year, average for many-year period	"	10.0	14.1	18.4	21.7	22.5
Capital investments in construction of system and agricultural assimilation of land	millions of rubles	40.0	48.6	60.0	86.8	120.0
Average annual profit	"	4.0	5.6	7.4	8.6	9.0
Time period for recouping capital investments	years	10	9	8	10	13
Calculated expenditures (per 1 ruble's worth of additional output)	rubles/ ruble	1.11	1.05	0.98	1.11	1.30

In the desert zone, where only irrigation farming is possible and there are no non-irrigated plantings in the immediate vicinity, and the irrigation norms depend very little on natural precipitations and in certain years change almost not at all, the consumption of water on one and the same irrigated area remains identical, and frequently it depends more on the sources of irrigation water than on the conditions for natural moisture. In certain years or periods of the year surplus irrigation water cannot be used for adjacent desert land. Therefore the areas of irrigation, when the handling capacity of the main structures remain the same, remain constant (stable irrigation) and the agricultural enterprises are interested in a fuller annual supply of water only for the irrigated areas they already have. Artificial irrigation in the desert zone transforms almost fruitless land into highly productive agricultural land with repeatedly increased productivity of each irrigated hectare, and almost all of the products are the result of irrigation and measures related to it. It is expedient to distribute irrigated land here in the form of large oases that suffer less from the drying effects of the surrounding desert.

The situation is different in the steppe, forest steppe and nonchernozem zones where artificial irrigation is conducted mainly on areas that were previously used for non-irrigation farming and produce considerable volume of agricultural products even without artificial irrigation. In these zones the productivity of agricultural land increases as a result of additional irrigations. The farms in regions of non-irrigation farming want the irrigations to be used just as fertilizers are applied and other agrotechnical measures are conducted, and not always on strictly allotted sections, but, as much as possible, on any part of the farms where during one year or another or during one period of the year there arises a need for additional moisture (mobile irrigation). This can be achieved only with a deconcentration of the distribution of irrigated land, whose agricultural production can be expediently and efficiently combined with adjacent non-irrigation planting.

The main object of the work envisioned in the new Construction Norms and Rules of the USSR Gosstroy, that went into effect in 1975, consists in selection and technical and economic substantiation for each irrigation object the level (percentage) of calculated irrigation whereby one achieves the most expedient combination in the utilization of water and land resources and effective production of the largest possible quantity of agricultural products both on permanently irrigated land and other land of agricultural enterprises that are included in the zone affected by artificial irrigation.

A technical and economic substantiation is drawn up for each object (farm, area, system, or region) on the basis of data concerning the annual irrigation norms per one hectare for individual crops and the average weighted irrigation norms that are determined taking into account the makeup of the crops. In keeping with the established grouping of years according to the degree of aridity, the calculated provision has five gradations: years with 95-percent provision (the most arid years), 75-percent (semi-arid years), 50-percent (average years), 25-percent (semi-wet years), and 5-percent (wet years). A comparison of the technical and economic indicators for these variants will serve as a basis for selecting the most economical of them. Presented below are calculations that were made with respect to the irrigation system of the steppe region (south of the Ukraine) which is allotted 50 million cubic meters of irrigation water a year. For an initial comparison and selection of the most economical variant of the calculated supply they used data

Table 2. Utilization of Irrigation Water and Land With Irrigation Network With Various Levels of Calculated Water Supply for Irrigation

	Unit of Measurement	Calculated Water Supply				
		95%	75%	50%	25%	5%
Annual resources of irrigation water	millions of cubic meters	50	50	50	50	50
Average annual utilization of irrigation water (during many-year period)*	"	25.5	35.4	44.5	49.2	50.0
Average annual quantity of water remaining unused	"	24.5	14.6	5.5	0.8	0.0
Average annual percentage of utilization of irrigation water	%	51	71	89	98	100
Overall area of land in zone affected by irrigation	thousands of hectares	50	50	50	50	50
Area of land with irrigation network	"	10.0	14.3	20.0	33.4	50.0
Area of land with actual watering (average annual for many-year period)	"	10.0	14.1	18.4	21.7	27.5
Actual irrigated area in percentage of area with irrigation network	%	100	98	92	65	45
Area of land with irrigation network in percentage of overall area of land located in zone affected by irrigation	"	20	28.6	40.0	66.4	100

* The degree of utilization of water was determined for a 20-year period. For each variant a calculation was made for very dry years (1 year), medium dry years (4 years), average years (10 years), medium wet years (4 years) and wet years (1 year), using the corresponding irrigation norms.

concerning capital investments and planned profit obtained as a result of these investments, which served as a basis for determining the time periods for recouping capital investments--one of the main indicators of economic effectiveness. The comparative effectiveness was determined according to the expenditures that were made. The indicators of the economic effectiveness of the compared variants depend on the degree of utilization of irrigation water and land with the irrigation network.

Accounting for the water consumption over a period of many years (in the example under consideration--20 years) makes it possible to establish the actual utilization of water in terms of all the variants for the years with various amounts of natural moisture and to establish the average annual amounts for the many-year period.

One can see from Table 2 that with a 95-percent calculated supply of water resources, only 51 percent are used. As the level of the calculated supply decreases the degree of utilization of the water increases, and the most efficient application of the water is found in the transition from a 95- to a 75- and 50-percent supply, precisely from 51 percent to 71 percent and 89 percent of the utilization of the existing resources of irrigation water.

When determining the economic effectiveness of irrigation with the variants that are being compared, it is important to take into account the sizes of the areas with the irrigation network and the actual irrigated network during a period of many years. As the level of the calculated supply decreases, the areas of irrigated land (more precisely, land with an irrigation network) increase considerably more rapidly than do the areas which could actually be irrigated. Thus with the reduction of the calculated supply to 25 percent and 5 percent, the proportion of areas with an irrigation network that remain unirrigated increases significantly in individual years, which negatively affects the effectiveness of capital investments in the construction of an irrigation network.

Complete annual irrigation of all areas with an irrigation network can not be achieved except with the 95-percent variant of calculated water supply, and the quantity of unirrigated land increases as the percentage of the calculated supply decreases, and water irrigation resources are utilized completely only with the five-percent variant of calculated supply. With the other variants, part of the irrigation water cannot be used in individual years.

With the 50-percent variant of calculated supply (most effective), out of 50 million cubic meters of water an average of 5.5 million cubic meters of water a year or 11 percent remain unutilized. To expend this amount with ordinary methods requires a considerable increase in the area with an irrigation network, which is tantamount to changing over to a lower calculated water supply, and this is less economically effective than the 50-percent supply. This is related to the need to construct an irrigation network on very rarely irrigated land. The aforementioned reserve of water can be utilized on the basis of an experiment of the kolkhozes and sovkhozes in irrigating non-irrigated land without constructing a permanent irrigation network. At the present time about half of the aforementioned area for irrigation of non-irrigated land is irrigated with mobile equipment.

The planned level of calculated supply, determined on the basis of a comparison of technical and economic indicators for several variants, as a rule, is lower than the normative of the 95-percent calculated supply. Moreover, the area of land with a permanent irrigation network increases. In the example under consideration this area increases 2-fold--from 10,000 to 20,000 hectares, even without accounting for irrigation of additional areas with mobile equipment.

A combination of irrigation farming and non-irrigation farming makes it possible to conduct selective irrigations of the more valuable crops and areas that are most greatly in need of water during a given period, thus providing for increased effectiveness of the utilization of each cubic meter of irrigation water. Ordinarily non-irrigated land can even be irrigated with water that is intended for permanently irrigated land which does not require it during the period of the regular irrigation or requires less than does the area that lies outside the irrigated sector but is experiencing a great shortage of moisture. Such selectivity and mobility of irrigations within agricultural enterprises is an important means of increasing the proportion of more intensive crops as compared to the amount of them in the existing crop rotation. Sometimes the farms (especially when there is a shortage of water) irrigate only the areas that are planted in the leading crops, and the irrigation equipment is moved during the process of the crop rotation along with these crops. Irrigation in regions of non-irrigation farming should be carried out along with other agrotechnical measures not on limited sections of stable irrigation, but on any part of the farm where there is a need for additional moisture.

Mobile irrigation in full volume is a task of the more distant future, but even now it should be introduced and taken into account when planning, designing, constructing and operating irrigation systems, and organizing agricultural utilization of irrigated land and non-irrigated land adjacent to it. Practice shows that this method is also effective with the current level of technical equipment for irrigation. Mobile irrigation opens up large possibilities for further utilization not only of irrigation water, but also natural precipitation on the territory of each farm through the use of regulating irrigations, primarily of non-irrigated land.

In regions where irrigation is carried out against a background of mainly non-irrigation farming, artificial irrigations play a dual role. First, they augment moisture supplies in the soil by increasing the intake part of the land's water balance. The effect of this is determined by the ratio between expended water and additional yield--the coefficient of water consumption. Second, with irrigations it is possible to make up for the "gaps" in the schedule of the plants' water consumption that form during dry periods, that is, it is possible to regulate water consumption.

Fluctuations in the yields of agricultural crops in the steppe, forest steppe and nonchernozem regions depend mainly on the more or less lengthy dry periods that occur here, disturbing the normal development of the plants. The negative effects of droughts are manifested not only in that they decrease the plants' supply of water, but also in that they reduce the degree of utilization of all precipitation. Thus frequently favorable moisture conditions provide for good initial development of the crop and quite favorable prospects for the yield, but a drought that occurs in the second half of the growing period makes it impossible to obtain a large yield. And if a drought comes during the first period of the crop's development, the weakened and frequently thinned plantings cannot subsequently utilize even very abundant

precipitation, which leads to a reduction of the yield. Thus a dry period reduces the effect of precipitation that falls both before and after this period. Irrigating planted areas during a drought eliminates the retardation of the plants' development and thus improves the utilization of natural precipitation that falls during the entire growing period.

Even a small amount of irrigation during a dry period, for example, 100-300 cubic meters per one hectare, can prevent a reduction of the yield. The effect of such an irrigation is conditioned not by the fact that the overall intake of water into the soil is increased by 5-10 percent, but by the fact that, because of its effect on the water conditions for the agricultural crops, they utilize more effectively the 3,000-4,000 cubic meters of natural precipitation. This means that a small irrigation norm during the period of the plants' most critical need for water increases the useful effect of the large quantity of natural precipitation many times over.

In the steppe, forest steppe and nonchernozem regions there are usually from 300 to 500 millimeters of precipitation, which corresponds to an annual volume of 3,000-5,000 cubic meters of water per one hectare, and on one farm with an area of 10,000 hectares--30-50 million cubic meters. But because the precipitation is not uniform (throughout the territory of the farm) or regular, the useful utilization of it does not usually exceed 50 percent. Mobile irrigation, especially regulating irrigations, improves the effectiveness of natural precipitation. Thus an increase in the degree of the utilization of natural precipitation of only 20 percent is tantamount to the farm's obtaining an additional 6-10 million cubic meters of irrigation water, while expending on this measure a quantity of water that is several times less from the irrigation system.

Consequently, the use of mobile irrigation makes it possible not only to significantly increase the actual irrigated area and the amount of products obtained from it with the same water resources, but also to greatly increase the degree of utilization and productivity of each cubic meter of irrigation water and each millimeter of precipitation. These additional possibilities of mobile irrigation not only continue to be important when designing new irrigation systems, but also serve as an important means of increasing the economic effectiveness of the operation of existing irrigation systems.

In order to increase the efficiency of irrigation it is very important to improve the relations between state irrigation systems and agricultural enterprises that consume water, and also between water management construction organizations and agricultural organizations and enterprises. At the present time irrigation systems that are on the budget financing serve kolkhozes and sovkhozes that are autonomously financed organizations. The administrations of state irrigation systems can perform operations work and provide service for agricultural enterprises only within the framework established by plans and estimates of expenditures, in which it is impossible to take into account ahead of time the changing conditions of economic activity. Irrigation system workers are not materially motivated to improve their work. As distinct from autonomously financed enterprises that are motivated to economize on material and monetary resources, budget irrigation systems try as hard as they can to expend all funds allotted to them since residuals at the end of the year are identified with a failure to fulfill the plan.

Many shortcomings in the operation of irrigation systems, including wasteful utilization of water, are explained by the lack of material motivation to economize on "free" water. This pertains to state systems on budget financing that are constructed and operated with state allocations. In intrafarm irrigation systems that are put into operation, as a rule, at the expense of the farms themselves, which independently operate them, irrigation is conducted on the basis of autonomous financing, which has a positive effect on the economic indicators of irrigation.

The need to change water management organizations over to autonomous financing in order to cause them to expend water more economically is constantly increasing because of the annually increasing shortage of the water balance in the majority of basins of the main irrigated regions, particularly in Central Asia and Kazakhstan where the diversion of part of the flow of Siberian rivers involves the expenditure of many billions of rubles. Therefore it becomes especially important to take measures to economize on water. There are large unproductive losses of irrigation water in both old and new irrigation systems which are considered to be technically perfected. Extravagant utilization of irrigation water is brought about not so much by technical imperfection of the systems as by inefficient utilization of it because of the lack of payment for water and the lack of material motivation to economize on it. Therefore the complex of technical measures directed toward reducing losses of water and improving its application should be combined with measures for economy. Above all it is necessary to change land reclamation systems over to autonomous financing.

The experience in operating the Kubanskaya and Karagshskaya irrigation systems has shown that with the introduction of autonomous financing the actual irrigation norms are decreased by 20-30 percent just as a result of reducing useless losses of water, and without harming the crops. Practice shows that with the changeover to autonomous financing the agricultural enterprises and administrations of irrigation systems, on their own initiative and at their own expense, reconstruct systems and installations, striving to utilize water more effectively. The attitude toward accounting for water also changes. In systems that are maintained on budget finaning, even already installed water meters quickly begin to malfunction, and observations are made irregularly, as a result of which the supply of water meters does not exceed 50 percent, while in irrigation systems of the Kirghiz SSR all autonomously financed systems have a 100 percent supply of water meters.

The effects of autonomous financing factors, mutual responsibility and material incentives should be extended to the construction of irrigation systems as well. In order to increase the effectiveness of autonomous financing of interrelations between construction organizations and agricultural agencies and farms on which irrigation is conducted, the latter should be made responsible at least partially for the functions of the clients.

When irrigation systems are created on the land of agricultural enterprises at the expense of the state budget without financial participation from the farms themselves, the latter play a passive role, which impedes objective determination of the farms' actual need for irrigation, the actual possibilities of prompt assimilation of irrigated land and their effective utilization. Water management organizations do not depend on the effectiveness of the assimilation of the irrigated land and frequently conduct work without the necessary accounting for the interests and

capabilities of the agricultural enterprises. When a farm receives irrigation free of charge it is difficult to refuse to carry out even irrigation work which they can not assimilate. And the higher agricultural agencies are forced to be limited to sanctioning final plans. This leads to the construction of irrigation systems which are not properly utilized for many subsequent years.

Now the USSR Ministry of Land Reclamation and Water Resources orders, plans, and constructs new irrigation systems, and the USSR Ministry of Agriculture operates them. The builders are not very concerned about how they will be operated. For them the main thing is to economize on each hectare. But for the operators--the agricultural enterprises--this frequently ends up in inconveniences and large losses. They must eliminate at their own expense the imperfections caused by the construction workers, turning for assistance to seasonal workers, since water management construction organizations refuse to perform such work. With budget financing of irrigation systems not only all operations work, but also expenditures on eliminating imperfections in construction are covered by funds from the state budget, frequently by the same construction organizations, for more money. This makes the operating agencies less demanding of the construction workers and creates conditions for releasing and accepting irrigation systems that have imperfections. As a result the plans frequently include measures for reconstructing land reclamation systems that were recently constructed.

Increasing the importance of agricultural enterprises in efficient organization of irrigation requires the corresponding redistribution of capital investments in land reclamation between the USSR Ministry of Land Reclamation and Water Management and the USSR Ministry of Agriculture without increasing the overall amounts of investments, but increasing the economic substantiation and effectiveness of the irrigation work that is conducted.

From what has been presented above it follows that water reclamation has great reserves whose utilization will make it possible for agriculture to obtain more additional products as a result of more efficient utilization of irrigation water, increased material incentives for water management operation and construction organizations, and increased productivity of agriculture on the basis of autonomous financing.

A narrow departmental approach to solving the problems of autonomous financing impedes the establishment of overall material incentives of water management and agricultural enterprises and organizations to increase the efficiency of irrigat on and other land reclamation work that is conducted for agriculture. As VASKhNIL academician B. Shumakov emphasized: "One cannot forget that land reclamation does exist for itself, it is a branch of agriculture. And, this being the case, the final goal of all work is the crop."*

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*SEL'SKAYA ZHIZN', 5 December 1980